REMARKS/ARGUMENTS

Favorable consideration of this application in light of the following discussion is respectfully requested.

Claims 1-48 are pending in the application, with Claims 1, 2, 8, 10, 11, 13, 14, 15, 21, 23, 24, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 37, 39, 40, 41, 44, 45 and 47 amended by the present amendment.

In the outstanding Office Action, Claims 1-4, 20, 13, 15-17, 23, 26, 28-31, 33-37, 40, 44 and 46-48 were rejected under 35 U.S.C. § 102(b) as being anticipated by Wade (Anal. Chim Acta 215: 169-186, 1988); Claims 1-2, 10, 12-13, 28-31, 33-35, 37, 40, 43-44 and 46-48 were rejected under 35 U.S.C. § 102(b) as being anticipated by Kwiatkowski (Anal. Chim. Acta 112, 219-231, 1979); and Claims 5-9, 11, 14, 18-22, 27, 32, 38-39, 41-42 and 45 were indicated as containing allowable subject matter.

Applicants gratefully acknowledge the indication of the allowable subject matter.

Independent Claims 1, 15, 28, 33, 34, and 47 are amended to more clearly describe and distinctly claim Applicants' invention. Support for these amendments is found in Applicants' originally filed specification. Claims 1, 15, 28, 33, 34, and 47 are also amended to correct grammar. Dependent Claims 2, 8, 10, 11, 13, 14, 21, 23, 24, 26, 27, 29, 30, 31, 32, 35, 37, 39, 40, 41, 44, and 45, are amended to maintain antecedent basis. No new matter is added.

Briefly recapitulating, Claim 1 is directed to a method for mining mass spectra. The method includes a) specifying spectral characteristics of a mass spectrum to be mined; b) specifying a relationship between the spectral characteristics of the mass spectrum to be mined; c) searching the mass spectrum for portions of the mass spectrum which match the spectral characteristics based on the relationship; and d) assigning scores to the portions of

the mass spectrum to indicate a degree of correlation between the portions of the mass spectrum and the spectral characteristics.

Applicants' claimed method enables detection of tandem mass spectra data that corresponds to various peptide forms.[1] That is, conventional use of mass spectral data to predict chemical structures and even peptide sequences is well-described in the prior art. However, Applicants' claimed inventions do not predict structures or sequences from MS data. Rather, Applicants' claimed inventions identify data that displays specific characteristics ***defined by the user***. These characteristics include hierarchically defined combinations of loss ions, product ions and ion series. Independent Claims 15, 28, 33, 34, and 47 are directed to alternative embodiments, each identifying data that displays specific characteristics ***defined by the user*** and including hierarchically defined combinations of loss ions, product ions, and ion series.

Wade describes a pattern-recognition/artificial intelligence program called MAPS (method for analyzing patterns in spectra) which identifies structures of chemical substances by comparing the MS and MS-MS spectra of a chemical substance to a database of chemical substructures and associated MS and MS-MS spectral features. The generation of rules that express the correlation of MS and MS-MS spectral features and chemical substructures are described on p. 174, 2nd paragraph through p. 178, 5th paragraph. Wade describes on p. 176, lines 13-15 the population of a "feature bucket" that collects observed spectral features associated with specific compounds. The information in these feature buckets consists of compound names and lists of associated spectral features. The spectral features are not described in any quantitative manner (e.g., the intensity of signal peaks), but instead are recorded as lists of observations. Similarly, the "substructure buckets" consist of chemical substructures associated with lists of compounds which incorporate those substructures.

[1] Specification, page 2, lines 32-33.

Wade describes in the paragraph bridging p. 176-177 the correlation of the contents of the features bucket and substructure bucket based on frequencies with which substructures and features were observed together in MS and MS-MS data for a number of compounds in the database. These correlations generate rules (p. 178, 3rd paragraph) that are subsequently applied to MS and MS-MS spectra of unknowns to associate them with substructures in the database (p. 179, paragraphs 1 and 2).

However, Wade does not disclose or suggest Applicants' claimed steps of b) specifying a relationship ***between*** the spectral characteristics ***of the mass spectrum*** to be mined; c) searching the mass spectrum for portions of the mass spectrum which match the spectral characteristics based on the relationship; and d) assigning scores to the portions of the mass spectrum to indicate a degree of correlation between the portions of the mass spectrum and the spectral characteristics. As previously described, Wade stores one or more spectral characteristics of a known compound as well sub-structures of the compound in a database (i.e., a relationship between a spectrum and sub-structures of the known compound). Then, one or more spectral characteristics of an unknown compound are compared to the stored characteristics of the sub-structures of the known compound in order to identify the unknown compound and/or to identify similarities/dissimilarities between the known and unknown compounds. However, Wade does not specify a relationship ***between*** the spectral characteristics ***of the mass spectrum to be mined*** (e.g., an unknown compound). An example of a relationship ***between*** the spectral characteristics ***of the mass spectrum to be mined*** is an ion series, which is a group of spectral signals separated by a defined distances on the m/z axis within a spectrum (see p. 11, lines 11-23 of Applicants' originally filed specification). Because Wade does not specify a relationship ***between*** the spectral characteristics ***of the mass spectrum to be mined***, Wade also does not search ***based on the relationship***. And, because Wade does not search based on the relationship, Wade does not identify portions of

the mass spectrum that correspond to the relationship and thus does not assign scores to the portions of the mass spectrum to indicate a degree of correlation between the portions of the mass spectrum and the spectral characteristics.

The Office communication states (p. 3, lines 1-3) that "with respect to the steps of claim 1, the first three steps are covered as the computer uses the established rules to look for a substructure in unknown spectra." This analysis is incorrect as the MAPS algorithm can only incorporate rules described from specific chemical substructures, as described above. Applicants' claimed invention does not recite or require the derivation of spectral features from a database or from chemical characteristics of analyzed compounds. The first two steps of Claim 1 indicate that spectral characteristics and their relationships are specified, but do not require that they be derived from previously recorded spectra, as does Wade. The lack of such constraints is a key feature of Applicants' claimed method, as the claimed method maximizes flexibility in the generation of scoring strategies for different purposes. Moreover, Wade does not describe any specification of a hierarchy of spectral features to be scored as recited in Applicants' Claim 4. The calculation of a "match value" (noted on p. 3, lines 4-6 of the Office communication and discussed on p.180 of Wade) defines the minimum number of spectral features that must match a given rule for an association with a substructure. The match value of Wade adjusts the sensitivity of the MAPS algorithm, but does not score spectra in any way analogous to the final step of our Claim 1.

Kwiatkowski describes a combined forward and reverse library search algorithm for comparing mass spectra to spectra in a database or library. In the forward search, unknown spectra are searched against spectra of known compounds in the database to determine matches and possible identities of unknowns. In the reverse search, spectra of known compounds are searched against spectra of unknowns, again to identify matches and possible identities of the unknown compounds. The algorithms for the forward and reverse matches

are described in the paragraph bridging p. 220-221 and in Table 2. The comparisons generate binary data files, which describe the differences between the spectra being compared. When a signal at a specific m/z value is present in both or neither, a value of zero is recorded; when a signal is present in the library spectrum, but not the unknown spectrum, the difference is denoted by a value of one. Kwiatkowski describes a calculation of a "normalized dissimilarity index" (DI) on p. 222, line 2. The DI reflects the number of disagreeing bit positions in the binary string encoding the comparison and is normalized to the total number of possible comparisons. The DI values enable ranking of spectral matches in a "hit list," which reflects the quality of spectral matches and can be used to deduce possible identities of the unknowns. Kwiatkowski further describes the incorporation of peak intensity information into the scoring process by selectively scoring peaks within a specified range of intensities to generate DI values for each intensity range (p. 224, paragraphs 3 and 4). The resulting hit lists from different intensity ranges are combined to form a combined hit list, from which the distribution of scores is evaluated (p. 224, 4th paragraph and illustrated with an example in Figure 4, p. 226-227 and Table 3 (which is not labeled, but appears in the middle of p. 227)). The reverse library search described by Kwiatkowski searches spectra for signals only at specific m/z values that display signals in a library spectrum. Kwiatkowski does not evaluate signals in a spectrum unless they are present in the library spectrum, as specifically noted on p. 221, lines 10-14.

However, like Wade, Kwiatkowski does not disclose or suggest Applicants' claimed steps of b) specifying a relationship ***between*** the spectral characteristics ***of the mass spectrum to be mined***; c) searching the mass spectrum for portions of the mass spectrum which match the spectral characteristics based on the relationship; and d) assigning scores to the portions of the mass spectrum to indicate a degree of correlation between the portions of the mass spectrum and the spectral characteristics. As previously described, Kwiatkowski stores one

or more spectral characteristics of a known compound in a database (i.e., a relationship between a spectrum and a compound). Then, in the forward search, a mass spectrum of one unknown compound is compared to the stored characteristics of a plurality of known compounds in order to identify the unknown compound and/or to identify similarities/dissimilarities between the known and unknown compounds. Then, in the reverse search, stored characteristics of one known compound are compared to the spectrum of a plurality of known compounds in order to identify the unknown compounds and/or to identify similarities/dissimilarities between the known and unknown compounds.

However, like Wade, Kwiatkowski does not specify a relationship ***between*** the spectral characteristics ***of the mass spectrum to be mined*** (e.g., an unknown compound). Because Kwiatkowski does not specify a relationship ***between*** the spectral characteristics ***of the mass spectrum to be mined***, Kwiatkowski also does not search ***based on the relationship***. And, because Kwiatkowski does not search based on the relationship, Kwiatkowski does not identify portions of the mass spectrum that correspond to the relationship and thus does not assign scores to the portions of the mass spectrum to indicate a degree of correlation between the portions of the mass spectrum and the spectral characteristics.

MPEP § 2131 notes that "[a] claim is anticipated only if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference." *Verdegaal Bros. v. Union Oil Co. of California*, 814 F.2d 628, 631, 2 USPQ2d 1051, 1053 (Fed. Cir. 1987). "When a claim covers several structures or compositions, either generically or as alternatives, the claim is deemed anticipated if any of the structures or compositions within the scope of the claim is known in the prior art." *Brown v. 3M*, 265 F.3d 1349, 1351, 60 USPQ2d 1375, 1376 (Fed. Cir. 2001) (claim to a system for setting a computer clock to an offset time to address the Year 2000 (Y2K) problem, applicable to records with year date data in "at least one of two-digit, three-digit, or four-digit"

representations, was held anticipated by a system that offsets year dates in only two-digit formats). See also MPEP § 2131.02. "The identical invention must be shown in as complete detail as is contained in the ... claim." *Richardson v. Suzuki Motor Co.*, 868 F.2d 1226, 1236, 9 USPQ2d 1913, 1920 (Fed. Cir. 1989). Because both Wade and Kwiatkowski fail to disclose or suggest all the features recited in Claims 1, 15, 28 and 33, Wade and Kwiatkowski each do not anticipate the invention recited in Claims 1, 15, 28 and 33, and all claims depending therefrom.

Accordingly, in view of the present amendment and in light of the previous discussion, Applicants respectfully submit that the present application is in condition for allowance and respectfully request an early and favorable action to that effect.

Respectfully submitted,

OBLON, SPIVAK, McCLELLAND,
MAIER & NEUSTADT, P.C.

Eckhard H. Kuesters
Attorney of Record
Registration No. 28,870
Michael E. Monaco
Registration No. 52,041

Customer Number
22850

Tel: (703) 413-3000
Fax: (703) 413 -2220
(OSMMN 08/03)
EHK/MEM/kkn

I:\ATTY\MM\AMENDMENT\2204\204931US-AM.2.DOC